comprise labeled binding reagents (e.g., antibodies, nucleic acids, labeled analogs of analytes of interest, etc.), detection chambers **945** and/or **946** comprise one or more immobilized binding reagents (preferably, an array of immobilized binding reagents, most preferably immobilized on electrodes for conducting ECL assays) and reagent chamber **925** comprises a wash reagent for removing sample solution and/or unbound labeled reagents from the detection chambers. In embodiments where one of the detection chambers is used for control assays or for assay calibration, the associated pill zone may comprise control reagents such as an added analyte (for example, to be used in spike recovery, calibration measurements or control assay measurements).

[**0231**] The fluidic network of cartridge **900** comprises z-transitions that may act as capillary breaks and/or allow for the fluidic network to be extended to multiple planes of the cartridge. See, e.g., Z-transitions **1010-1014** in **FIG. 10**. Z-transition **1011** in the sample conduit and **1013** in the reagent conduit act as capillary breaks which confine sample liquids and reagent liquids to their corresponding chambers. Fluid can be moved from these chambers, in a controlled and reproducible manner, by application of an appropriate pressure gradient. Z-transitions **1060** and **1061** allows the waste conduits to cross sample conduit branches **940** and **941** by arranging them on different layers of the cartridge.

[**0232**] **FIGS. 13***a* and **13***b* show exploded views of one embodiment of cartridge **900** that comprises cartridge body **1100** and cover layers **1324**, **1350**, **1320**, **1321** and **1322** mated to the surfaces of cartridge body **1100**. **FIG. 11** shows top (**FIG. 11***a*), bottom (**FIG. 11***b*) and isometric (**FIG. 11***c*) views of cartridge body **1100**. The upper **1101**,**1102** and lower **1103** surfaces of the cartridge body **1100** incorporate (e.g., by molding, machining, etching, etc.) recessed features such as channels, grooves, wells, etc. The features are sealed to provide the chambers and conduits of the cartridge by applying the cover layers to the upper and lower portions of the cartridge body. To allow for adequate sample and/or reagent volumes, the cartridge body has thicker portion **902** which includes features (channels, grooves, wells, compartments, etc.) that define, in part, the sample, reagent and waste chambers. The remainder of the cartridge is, preferably, much thinner so as to minimize cartridge weight, volume and material costs and, in the case, of certain preferred cartridge designs, to allow optical detectors to as close as possible to the top surface of electrodes incorporated on a cover layer on the bottom of a cartridge.

[**0233**] Reagent chamber **925**, sample chamber **920**, waste chambers **930** and **931** and at least portions of the sample conduit, reagent conduit and waste conduits **960** and **961** are formed by sealing cover **1324** on cartridge body **1100**. Detection chambers **945** and **946** are formed by sealing cover layer **1350** (having patterned conductive layer **1360** (which forms the patterned electrode array **963**, shown in **FIG. 9**) and patterned dielectric overlayer **1365**) to cartridge body **1100** through intervening gasket layer **1331** (preferably, made from double sided adhesive tape). The detection chamber's depth, length and width are defined by cutouts **1340** and **1341** within the gasket layer. Cover layer **1322** mates to cartridge body **1100** through gasket layer **1330** (preferably a double sided adhesive tape) to define conduit segments, such as **1060** shown in **FIG. 10**, that (via formation of double z-transitions) act as bridge segments connecting the fluidic networks defined by cover layers **1324** and **1350**. Advantageously, the use of a such a "bridge" cover layer allows cover layer **1350** having patterned electrodes (and, optionally, patterned binding reagents on the electrodes) to be only slightly larger than the patterned components. This arrangement decreases the cost of the patterned component. Alternatively, the bridge cover layer and associated double z-transitions can be omitted and cover layers **1324** and **1350** can be combined into a single contiguous cover layer. Optionally, pill zones containing dry reagents pills are located on cover layer **1332** in the regions that are exposed by openings **1345** and **1346** in gasket **1330** so that they the reagents are reconstituted in liquids passing through the pill zones on the way to detection chambers **945** and **946**. Cover layer **1321** seals air chamber/trap **976** and the top side conduit segments which include double z-transition connecting segments **1070** and **1071**. Cover layer **1320** seals sample introduction port **921** and reagent introduction port **922**.

[**0234**] In the preferred embodiment shown in **FIGS. 11 and 13**, the cartridge body further includes electrical access regions **995** and **996** that, together with cutouts **1370** and **1371** in gasket layer **1331** allow electrical contact to be made with electrode contacts **997**,**998**. Electrical access regions are cut-outs or holes in the cartridge body configured and arranged to be in alignment with the electrode contacts.

[**0235**] At least a portion of cartridge body **1100** is adapted and configured to be an optical detection window and is arranged in optical registration with the electrodes to allow optical detection of luminescence generated by the electrode array. In one particularly preferred embodiment, the cartridge body and/or the cover layers are fabricated from a translucent material. The use of optically transparent materials has the further advantage that optical detectors, e.g., detectors arranged within a cartridge reader, can be used to detect the presence of liquids in the conduits. These optical detectors can be used to ensure that the cartridge is functioning properly and to provide feedback to the control systems controlling fluid movement in the cartridge. Alternatively, the cartridge body and/or cover layers may contain optical detection windows that are properly arranged locations that require optical detection of fluid presence and/or composition (e.g., detection of reflectance/transmittance from a light source). **FIG. 12** depicts preferred locations for optical detection points **1210-1217** in cartridge **900**.

[**0236**] **FIG. 14***a* is a schematic representation of the fluidic components of cartridge **1400**, another preferred embodiment of the cartridge of the invention. **FIGS. 14***b* and **14***c* show exploded views of one preferred design of cartridge **1400**. **FIG. 18** is a three dimensional representation of the fluidic network of this design. Cartridge **1400** comprises a sample chamber **1420**, first and second reagent chambers **1425** and **1426**, detection chambers **1445** and **1446**, waste chambers **1430** and **1431**. Sample chamber **1420** is preferably adapted to receive a liquid sample and is linked via vent conduit **1475** to vent port **1480** and via sample conduit **1415** (including sample conduit branches **1440** and **1441** that branch from distribution point **1540**) to detection chambers **1445** and **1446**. Vent conduit preferably has a serpentine shape to increase its length and prevent fluid from bubbles in sample chamber **1420** from back-flowing into vent port **1480**. Sample conduit **1415** preferably comprises a z-transition near the conduit connection to the sample chamber **1420** for preventing premature leakage of